SUSTAINABLE AGRICULTURE: A TIME FOR EDUCATION

by

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SUSTAINABLE AGRICULTURE: A TIME FOR EDUCATION

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Abstract

This study used a fifteen-question survey to identify the articulation between education of water quality practices and the willingness to implement sustainable water quality techniques on farmland according to twenty-five agricultural operations residing on the Central Coast. Questions one through eight asked respondents to indicate their agreement or disagreement with various water quality assessment tools. Questions nine through twelve asked respondents to personally rate their operation's level of water quality management on a scale from one to ten. Questions thirteen through fifteen were open-ended questions to generate responses about demographics. Consensus was reached that the higher the level of education about water-quality planning techniques, the higher the adoption rate of sustainable water quality implementation on farmland. In essence, this means less likelihood for surface water runoff and a high level of compliance with water-quality regulation

CHAPTER ONE

INTRODUCTION

Most everyone is familiar with the "Go Green" or "environmentally friendly" trend that is making its way through most every industry throughout the world. Look around and you will see sustainable restaurants, paperless offices, commercials asking families to turn their thermostat down or to purchase certain types of light bulbs, and don't forget to ride your bike to work today! Well, agriculture is following this almighty trend by introducing a more sustainable way of farming to all types of producers. Expectedly, many people are wondering the meaning behind "sustainable agriculture" and why it should be considered. According to the *Journal of Sustainable Agriculture*, the definition of Sustainable Agriculture is "a philosophy based on human goals and on understanding the long term impact of our activities on the environment and on other species (Francis 1990)." While this definition is very broad, Sustainable Agriculture Research & Education describes sustainable agriculture by stating:

> This agriculture is profitable, protects the nation's land and water and is a force for a rewarding way of life for farmers and ranchers whose quality products and operations sustain their communities and society (Waldron, Lehner, Clark & Friedman, 2008, p. 2).

With the popularity of "sustainable" practices many producers, consumers and marketers use sustainability in a multitude of contexts making the new practice sometimes hard to understand. Because of the common misunderstandings within the definition of agriculture sustainability and common misconceptions within implementation practices, farmers have been reluctant to separate from their conventional way of farming. The adoption of sustainable agricultural practices has become a popular

research topic. According to Alonge and Martin, research shows that many farmers are aware of the effects their practices have on the environment, they are aware they are responsible for protecting the environment, and they had favorable attitudes towards soil and water conservation, but they still decided to continue their conventional way of farming. Critics have argued that the reason that farmers are reluctant to adopt sustainable agriculture can be contributed to the lack of understanding about the practice. Alonge and Martin have concluded that it was likely that the successful adoption of sustainable agriculture practices is dependent on a farmer's attitude and perception, more-so than any other factor. Another speculation about sustainable agriculture is the question of its profitability and compatibility in relation to a farmer's present way of farming (Alonge & Martin, 1995, pp 35).

Much of the reluctance to adopt sustainable farming practices can be accredited to the lack of education that many farmers have about the alternative way of farming. For example, *The Journal of Sustainable Agriculture* describes common myths that farmers associate with sustainable agricultural practices. Charles Francis reveals the following myths: First, low input methods are only for small farmers, low- input farming means "cold turkey" on the entire farm, low-input farming reduces yields and increases risk and low- input farming means low levels of management (Francis, 1990, pp98-99). In truth, all of these statements are incorrect but still assumed to be correct by farm representatives. Many have not taken the time to further their research and concern for a better way of farming, while some are just not interested. It would be interesting to know if an informative workshop based on sustainable agriculture would change the outlook of these alternative practices on conventional farmers.

STATEMENT OF THE PROBLEM

Because of the increasing push for environmentally friendly farming, "sustainable agriculture" has been a very trendy phenomenon. It is important for the farmer to understand the concepts of sustainable farming and to have information readily available. The lack of education that most farmers have about sustainable agriculture has been a direct relationship to their reluctance to adopt sustainable practices. The problem is that there is a lack of educational resources available to those farmers considering sustainable farming.

IMPORTANCE OF THE PROJECT

Sustainable agriculture needs to be pursued further. There needs to be more educational outreach opportunities available to farmers to clear up misconceptions and to answer questions and concerns regarding this positive practice. As Alonge and Martin noted, with some farmers implementing elements of sustainable agriculture to their farming systems, a significant number of farmers admitted they were in the "information gathering" stage of the adoption process. This is an eye opener to agricultural education. It provides a large incentive to concentrate more attention on the understanding of sustainable agriculture. Farmers need to be provided adequate agronomic and economic research about the practices (Alonge & Martin, 1995, pp .40). By discovering the affects that education would have on the adoption of sustainable agriculture would be beneficial to multiple parties. Farmers would have their concerns met; outreach programs would receive public input which would lead into further research studies. We can narrow down the demographics of those farmers who are most likely to adopt sustainable practices and help to facilitate a more environmentally friendly way of production. In addition, available funding is another important factor that many agriculturalists are not aware,

their knowledge about funding may increase their likelihood to adopt earth-friendly practices. For example, USDA's Sustainable Agricultural Research Extension program helps advance farming systems that are profitable, environmentally sound and benefit communities through a national research and education grant program. The program funds projects and conducts outreach designed to improve agricultural systems using sustainable practices. SARE grants run as high as one hundred and thirty-eight thousand, five hundred and thirty-nine dollars ($138,539) for research and development are funded to chosen applicants demonstrating successful use of agriculture sustainable practices (Feenstra & Ohmart, 2006, pp. 10-11). Another important purpose for this study is to identify simple implementation practices that can be passed on to homeowners to assure a more sustainable agriculture in the backyards of consumers.

PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study is to receive multiple opinions from local farmers about agriculture sustainability and formulate a conclusion as to the reason that some farmers are reluctant to adopt sustainable practices. It would be beneficial to know if outreach programs would affect the number of farmers to adopt any form of sustainable practice. Examples include changing an irrigation system, changing disposal practices for certain products, or by restricting chemical use in the fields or using a more renewable source of energy for production. Determining the level of awareness among farmers could depend on the long term affects that more sustainable practices will have on agriculture, a primary example being the availability of water or the continuous texture of soils. As a final outcome, it is important to know the farmers' opinion on sustainable practices and what they think of the definition of "sustainable". Based on the purpose of this study, the following research questions were developed to guide the study.

- **RQ1-** What are the perceptions of a sample of farmers towards the terms "sustainable" or "regenerative" in agriculture?
- **RQ2-** What are farmer's perception of sustainable agriculture implementations?
- **RQ3-** How do farmer's adoption preferences affect their attitudes towards the adoption of sustainable practices in other farmers?
- **RQ4-** What are farmer's profitability perceptions related to the adoption of sustainable agriculture?

OBJECTIVES OF THE PROJECT

The objectives to accomplish the purposes of this project are:

- Determine the openness of farmers to adopt sustainable practices:
    - Survey Central Coast Farmers enrolled in an Agriculture Waiver Program.
    - Conduct in-person interview with Central Coast farmers regarding their farming practices and feelings towards sustainability.
- Create a sustainable guide for homeowners- garden, water conservation, lawn.
- Determine if education about sustainability influences the want to practice this type of farming.

DEFINITIONS OF KEY TERMS

- ***Sustainable Agriculture:*** philosophy based on human goals and on understanding the long term impact of our activities on the environment and on other species. (Francis, pp. 97).
- ***Regenerative Agriculture*:** Defined by the USDA under sustainable agriculture publications as "enhanced regeneration of renewable resources is essential to the achievement of a sustainable form of agriculture," and (2) "the concept of

regeneration would be relevant to many economic sectors and social concerns." (United States Department of Agriculture, 2007).

- ***Low Input Agriculture:*** Defined by the USDA under sustainable agriculture publications as ""seek to optimize the management and use of internal production inputs (i.e. on-farm resources)... and to minimize the use of production inputs (i.e. off-farm resources), such as purchased fertilizers and pesticides, wherever and whenever feasible and practicable, to lower production costs, to avoid pollution of surface and groundwater, to reduce pesticide residues in food, to reduce a farmer's overall risk, and to increase both short- and long-term farm profitability."." (United States Department of Agriculture, 2007).
- ***Alternative Farming:*** Defined by the USDA under sustainable agriculture publications as a "term encompassing a vast array of practices and enterprises, all of which are considered different from prevailing or conventional agricultural activities." (United States Department of Agriculture, 2007).

STATING A HYPOTHESIS

1) If farmers and ranchers attended a workshop or seminar on sustainable agriculture, then the adoption of sustainable practices would be more likely.

2) Younger farmers will be more likely to adopt sustainable practices.

3) If farmers and ranchers already practice sustainable agriculture on their land, those farmers/ranchers will recommend sustainable water quality educational seminars to other farmers and ranchers.

SUMMARY

This paper discusses the definition of sustainable agriculture and the beneficial effect that is has on the longevity of agricultural production, the misconceptions associated with sustainable agriculture and the lack of education available to farmers regarding sustainable practices. With the help from many online resources this paper reflects on farmer's reluctance to adopt sustainable agriculture and identified a purpose to address the reasoning for the lack of adoption within this alternative agricultural approach. In order to do this, a survey will be sent out to local farmers questioning them about education, demographics, and willingness to adopt sustainable agriculture and to explain their sustainable implementations on their land, if they have already adopted.

CHAPTER TWO

REVIEW OF LITERATURE

SUSTAINABLE PRACTICES WITHIN AGRICULTURE

Sustainable agriculture is described as the long term impact on the environment involving healthier ways to manage land by using low input implementation practices. Sustainable systems hope to reduce environmental degradation, maintain agricultural productivity, influence positive economic development and maintain stable communities and quality of life (Francis, 1990). The meaning behind sustainable development is arguable, but most would agree on the purpose of what sustainable practices are really about. Filho (2000) suggests the unlikely consensus of many individuals not knowing the definition of "sustainable" can be influenced by a person's training, work experience and political setting. Different views of sustainability have been documented which may further the understanding on the meaning behind sustainability. The primary three views of sustainability include sustainability as food sufficiency, sustainability as stewardship and sustainability as community (Douglas, 2001). Sustainability as food sufficiency hopes to increase food production, sustainability as stewardship hopes to control damage to the environment and sustainability as community is defined as maintaining rural systems (Douglas, 2001). According to the *Assessment Of The Adoption of Sustainable Agriculture Practices*: Sustainable agricultural is represented by farming systems in which the use of purchased chemical-based inputs such as fertilizers and herbicides is significantly decreased in comparison with the conventional agricultural systems (Alonge & Martin, 1995, pp 34).

BARRIERS TO SUSTAINABILITY

Filho addressed the reasons why sustainability may be hard for the public to understand. Factors which influence the attitude towards sustainability include: knowledge, background, experience, perception, values and, context (Filho, 2000).

According to Filho, a range of opinions circulate regarding the concept of sustainability. Negative misconceptions are widely to blame for the farmers' reluctance to adopt sustainable practices. Filoh explains three of the most relevant barriers to sustainability:

1) Sustainability is too abstract

2) Sustainability is too broad

3) No personnel present to look after it

Other barriers of sustainability are the lack of education that is offered to farmers who may be willing to adapt. There are limited workshops or information booths for farmers and homeowners to learn more about implementation practices. Many ranchers are also hesitant to branch from conventional farming because it is the "traditional" way and many are afraid of a decrease in profitability.

CHALLENGES TO AGRICULTURAL SUSTAINABILITY

Sustainable agriculture also presents some unique challenges. There is question about whether sustainable agriculture is a philosophy, a long term goal, or a set of management practices (Francis, 1990). The numerous disagreements about what is meant by "sustainable" agriculture can bee seen further in this study. According to Charles Francis (1990):

"In part these are due to the lack of understanding or information, to arguments over terminology, or baggage attached to other terms or groups that have promoted reduced input approaches in the past (Francis, 1990, pp.98)"

The presence of myths that are associated with sustainable agriculture present barriers towards the adoption of this new management practice. Explained below are myths that have been spread due to the misunderstanding of sustainable concepts.

Charles Francis (1990) reveals the following myths:

- First, Low input methods are only for small farmers. Research shows that farmers who demonstrate low input methods have large farms. Practices on larger farms have been demonstrated on wheat and grain crop farmers on more than 3000 acres. In fact, it has been shown that farmers who practice low input strategies have a farm size that is above state average everywhere except Vermont. Success stories have been written about cattle ranchers, tobacco farmers, vegetables farmers and many more. Many farmers have found success through sustainable grants that they can receive through Sustainable Agricultural Research Extension (SARE) and in the long run sustainable farmers can earn a nice income simply from marketing techniques (Feenstra & Ohmart, 2006).
- The second myth states: Low- input farming means "cold turkey" on the entire farm. The truth is that farmers are not expected to completely stop using chemicals. A majority of farmers just cut back on their usage of chemical based insecticides. They may substitute soil inputs with a more environmentally friendly alternative or cut back on the current usage of the chemical.
- Next, Francis documents this myth: Low-input farming reduces yields and increases risk. This case may be true in some situations but not others. For

example, when switching to a new management practice, farmers are recommended to test the new alternative to only a few acres and improve practices to be more profitable and less harmful to the environment.

- Lastly, this myth was also discussed: Low- input farming means low levels of management. Instead, agricultural sustainability should be called "management intensive." Because farmers are using less pesticides and equipment running through the field does not mean that the farmer can lounge on the couch all day. These crops and animals need to be tended to and watched intently. Because there are less chemicals, disease is more apt to attack a field and when that happens, farmers need to respond quickly (pp 98-99).

Scientific constraints and environmental constrains are also a concern for sustainable agriculture. There have been declines in agricultural research productivity which can be worrisome to the future of this sustainable management practice. Without further research and implementation, the environment will continue to be thoughtless of pollutants, soil conditions, and water conservation. If farmers continue to perform careless practices, the environment will not allow further growth to take place in soils and water will quickly become unavailable. Research for sustainable practices should be a higher priority because with proper implementation the environment will be better off in time. Other agricultural research has been a priority and the total research budget cannot support everything. Environmental capacity is another concern. Soil erosion, water, pest control and climate change are all factors that can limit the implementation of sustainable agriculture (Ruttan, 1999).

ADOPTION OF SUSTAINABLE AGRICULTURE PRACTICES

The adoption of sustainable agricultural practices has become a popular research topic. According to Alonge and Martin (1995), research shows that many farmers are aware of the effects that their practices have on the environment and they are also aware they are responsible for protecting the environment. Many farmers have shown to favor attitudes towards soil and water conservation, but they still decided to continue their conventional way of farming. Critics have argued that the reason that farmers are reluctant to adopt sustainable agriculture can be contributed to the lack of understanding about the practice. Alonge and Martin have concluded that it was likely that the successful adoption of sustainable agriculture practices was dependant on the their attitude and perception about sustainable practices before farmers even took the time to educate themselves on the subject. The farmers' attitudes about a new approach was predetermined. Another speculation about sustainable agriculture is the question of its profitability and compatibility in relation to a farmers' present way of farming (Alonge & Martin, (1995).

Alonge & Martin (1995) have studied the demographics of farmers and how characteristics such as age, education, number of years farming and farm size related to the adoption of sustainable practices. Specifically, Alonge & Martin (1995) gathered one hundred and fifteen usable questionnaires addressing farmers adoption of sustainable agriculture. Research shows that 69.5% (N=115) of the respondents fell within the age group of twenty through thirty nine years of age and 33.9 % had completed a college level education. The average years farming was seventeen and a half years and the average farm size was from six acres to three thousand acres (Alonge & Martin, 1995).

Their research has concluded that age and education is directly tied to the willingness to adopt a more environmentally friendly farming practices.

A study was also conducted through the *Agricultural and Resource Economics Review* by D'Souza, Cyphers. and Phipps (1993) which concluded that age is likely to be negatively associated with the adoption of sustainable agriculture. Their research has also show that younger farmers are more likely to adopt new technologies Education (greater than high school education) is also shown to be a significant factor in the adoption of sustainable practices (D'Souza, Cyphers.& Phipps, 1993, pp 160).

INCENTIVES OF PRACTICING SUSTAINABLE AGRICULTURE

Producer incentives in return of incorporating sustainable management practices include subsidies which support agricultural production. According to the article by Tilman, Cassman, Matson, Naylor, & Polasky (1990), the Organization for Economic Co-operation and Development provided the U.S. two-hundred and eighty-three billion dollars in subsidies to support sustainable agricultural production. Many have concluded that a portion of this money should be directed to what they call "green payments" similar to incentives in countries like Australia, Canada and the European Union. "Green Payments" are given to farmers who adopt sustainable or environmentally friends ways for farming.

Conventional farming practices can be more costly because of price of inputs such as chemicals, fertilizers and machinery. Within the sustainable agricultural sector the U.S. has placed a tax on fertilizer usage and also pays farmers to take their farm land out of production for a specified period of time (Tilman, Cassman, Matson, Naylor, & Polasky, 1990). Policies developed by the agricultural sectors of government and by the

USDA have adopted new policies to help further the adoption of a greener tomorrow and in most cases, the farmers are rewarded for helping begin the trend in saving our environment. Policies which help lower inputs within agriculture include the Enviornmental Quality Incentives Program, Conservation Reserve Program, Farmland Retention Plans and sections within the 2008 Farm Bill.

USDA's Sustainable Agricultural Research Extension (SARE) program helps advance farming systems that are profitable, environmentally sound and benefit communities through a national research and education grant program. The program funds projects and conducts outreach designed to improve agricultural systems (Feenstra & Ohmart, 2006).

Consumers also reap benefits of sustainable practices. For example, according to the article by Tilman, Cassman, Matson, Naylor, & Polasky in 1990, pricing and labeling each type of livestock product to reflect the true total costs of its production could provide consumers with important information and with incentives for choosing alternative food products.

SUSTAINABILITY MANAGEMENT PRACTICES

To incorporate a more sustainable soil condition, Smith and McDonald (1998) have suggested improved rotation with legumes and weed control, a well balanced fertilizer, and adequate drainage. The structure of the soil can benefit from minimum tillage and "stubble" retention. To prevent erosion in the soil, sustainable farmers have used minimum tillage, plant cover and strip cropping. To incorporate a more sustainable water condition, farmers are encouraged to implement a strategic re-vegetation, less use of cultivation and develop a drainage plan (Smith & McDonald, 1998)

With the adoption of sustainable agriculture, farmers need to become an expert at observation, anticipation and applying principals. Participation is encouraged through education based on discovery and experimental practices (Sherwood & Uphoff, 2000, pp. 92). In order to keep the success of a farm, implementation practice is essential. It is suggested to practice sustainable farming on a small plot of land before implementing practices to entire crop. Farmers need to become scientists and record daily observations. With the data obtained farmers can easily alter components to make the outcome more desirable. For example, add less chemicals, more water, less sunlight and more shade.

According to Charles Francis (1990), other practices that farmers are incorporating into their operations to reduce costs and minimize harm to the environment include: introduction to drought tolerant hybrids and crops that have show to resist short periods of stress, varieties that have resistance to harmful pests and pathogens, planting shorter season crops to reduce risk, precise soil sampling and carefully analyzing the results, account for all of the nutrients in the system, increased crop rotations to reduce fertilizer cost and vanish the need for chemical control on specific pests (Francis, pp 100).

RECOMMENDATIONS FOR IMPLEMENTATION OF SUSTAINABLE PRACTICES

Alonge and Martin noted, with some farmers implementing elements of sustainable agriculture to their farming systems, a significant number of farmers admitted they were in the “information gathering” stage of the adoption process. This is an eye opener to agricultural education by providing a large incentive for educators to concentrate more attention on the understanding of sustainable agriculture. Farmers need

to be provided adequate agronomic and economic research about the practices (Alonge & Martin, pp .40).

SUMMARY

The purpose of this literature review was to inform readers about the different aspects of sustainable agriculture. Throughout this review readers will find the definition of sustainable agriculture, learn about sustainable practices within agriculture, be able to identify barriers to sustainability, recognize challenges to agricultural sustainability, be aware of recommendations for implementation of sustainable practices and the incentives of that goes along with these practices. Readers will also be informed about the adoption of sustainable agriculture practices.

Research performed in this literature review will be helpful to those who do not know a lot about sustainable agricultural practices. Studies throughout this paper are significant to the adoption rate of alternative practice and offers incite to those who are interested.

CHAPTER THREE

METHODS

The purpose of this study was to compare the adoption of sustainable water quality practices between farmers and ranchers within San Luis Obispo County. Participation in local workshop and education seminars targeted on bettering sustainable water quality management were also examined within this population.

POPULATION

Forty farmers and ranchers in San Luis Obispo County were chosen to participate in this study. The farms and ranches which were chosen are also enrolled in the water monitoring cooperative within the Central Coast Regional Water Quality Control Board, and staff within the Agricultural Waiver Program provided names, addresses and information about their irrigated acreage. These farms and ranches are commodity independent and exceed two hundred irrigated acres of agricultural related land, thereby increasing their likeliness to adopt a sustainable water quality management program.

INSTRUNMENT

The administered survey was an adaptation of a survey written and administered by the "Ranching Sustainability Self-Assessment Program" and Jim Zingo from the University California Cooperative Extension. Zingo was contacted, and subsequently gave his permission to use and adapt the survey questions. He requested to see the results once the surveys had been returned.

The final survey included fifteen questions regarding water quality planning, observation practices, prevention of run off to nearby water bodies, irrigation usages and awareness about the Central Coast Water Quality Control Board. See Appendix A.

Questions about water quality practices could be answered on a scale from 1 to 10, ten being the best form of practice and zero being poor form of sustainable water quality practice. Surveys were reviewed by an engineer in the Agricultural Waiver Department of the Central Coast Regional Water Board, Peter Meertens.

COLLECTION OF DATA

On the morning of October 2, 2009, notification post cards were sent to the forty farmers and ranchers. See Appendix B. Letters were giving them notice that in approximately one week they would be receiving a sustainable water quality management survey in the mail. Notifications, as well as the paper surveys were administered through the U.S. Postal Service. On the afternoon of October 7, 2009 the paper letter and survey were sent out in the mail. See Appendix C. In order to encourage participation in the sustainable water quality surveys, 6 by 9 inch manila folders were labeled with a destination address, a stamp and placed along with the survey. This made is as easy as filling out the survey and placing it into the nearest postal box for delivery. On the afternoon of October 21, 2009 reminder post cards were sent to those survey recipients who had not yet responded. See Appendix D.

ANALYSIS OF DATA

The raw data were entered into graphs created by using Microsoft Word and Excel spreadsheets. Scores to questions were used to decide if the attendance of educational workshops and seminars had a direct relationship with better sustainable water quality management practices. Values signifying participation in educational workshops were considered statistically significant when comparing the excellence of sustainable water quality practices within these farms and ranch operations. Operations

unaware or uninterested in education regarding sustainable water quality management programs were likely to have a lower quality management score on surveys.

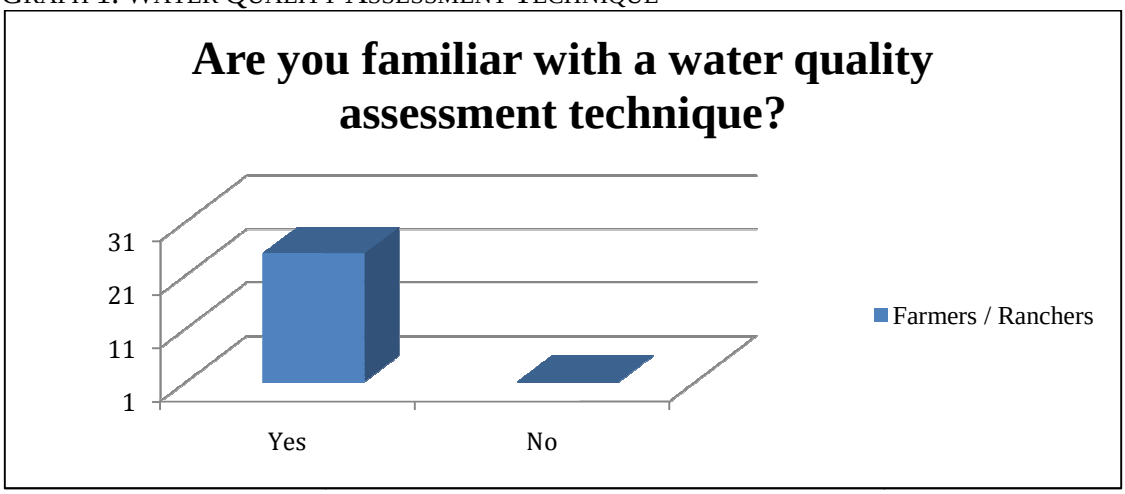
CHAPTER FOUR

RESULTS AND DISCUSSION

Results shown below are based on the twenty-five respondents who replied to the fifteen question survey which was sent to farmers and ranchers residing in San Luis Obispo County. Surveys were sent through the U.S. Mail Service. The analysis of the results can be observed through a simple bar graph. Participants answered the following fifteen survey questions and their results can be observed in the graphs below.

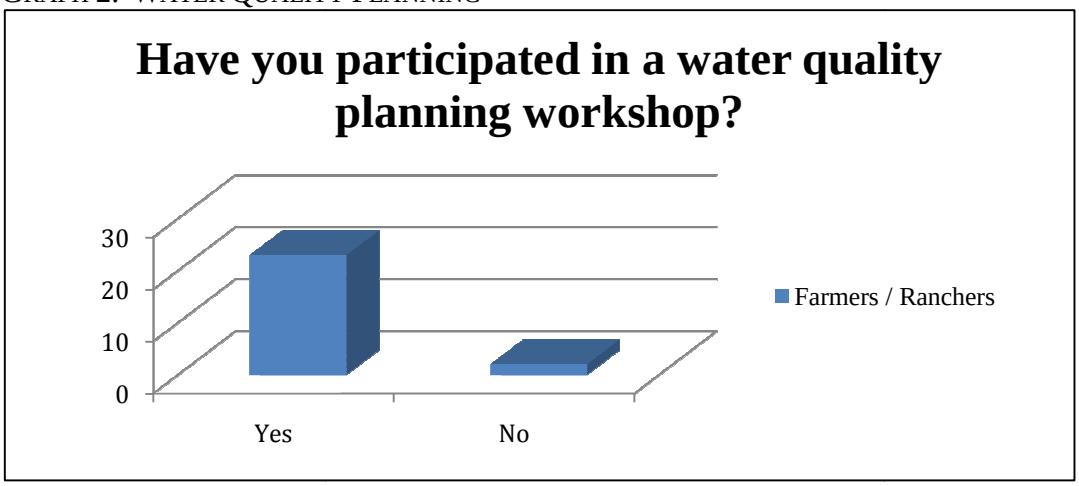
RESULTS

GRAPH 1. WATER QUALITY ASSESSMENT TECHNIQUE



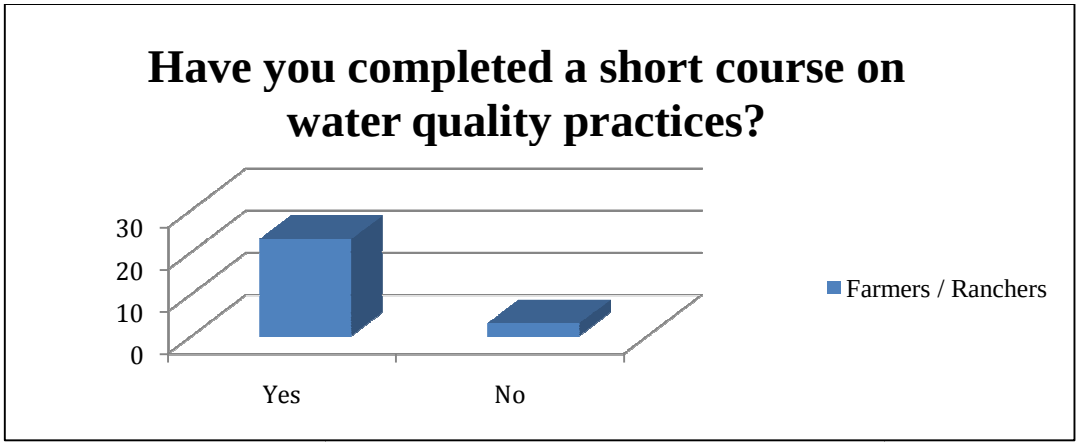
According to the graph shown above, twenty-five out of 25 participants indicated that they were familiar with some sort of water quality assessment technique. Awareness among 100% of respondents about water quality assessment techniques was very encouraging.

GRAPH 2. WATER QUALITY PLANNING



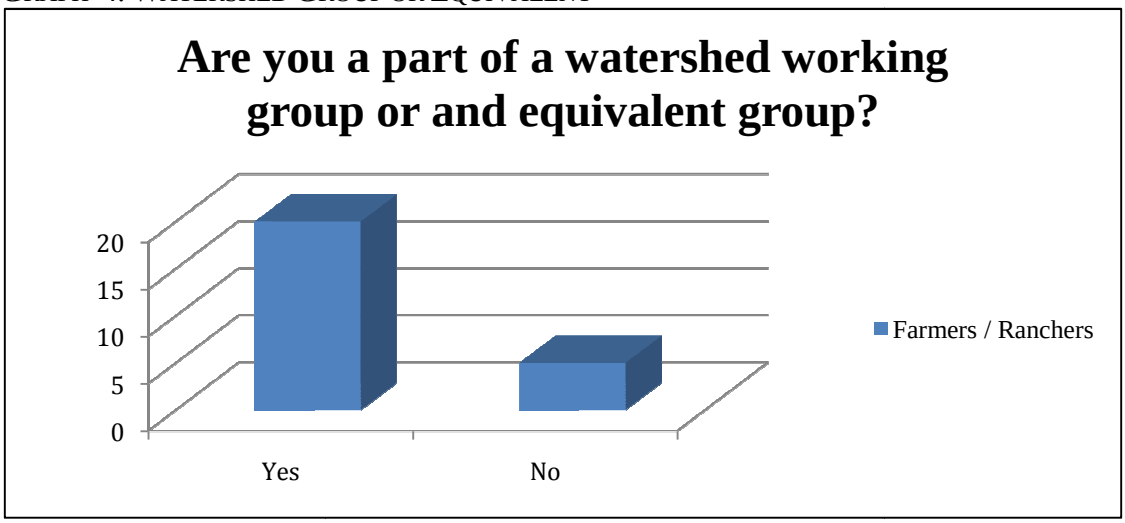
One of the more important concepts of the water quality assessment was the response to educational workshop participation among farmers and ranchers with high levels of irrigated land. Twenty-three out of 25 respondents indicated that they had participated in a water quality planning workshop. Two out of 25 participants had indicated that they had not participated in a planning workshop targeted towards water quality management on farms. Irrigation schedules are very important and water quality planning workshops can be helpful for the simple reason that they provide a foundation for farmers and ranchers as how not to over irrigate.

GRAPH 3. SHORT COURSES ON WATER QUALITY PRACTICES



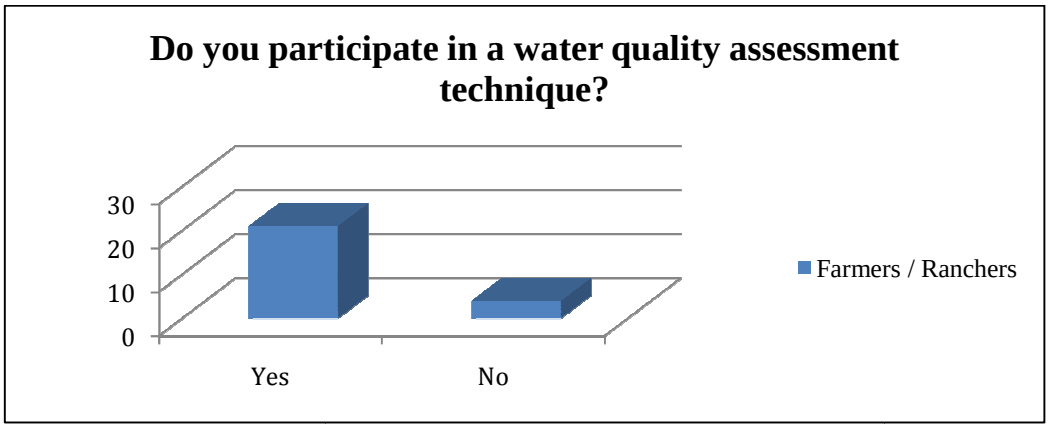
A short course in water quality focuses more primarily on practices that can be used to help decrease the likelihood of contaminated water making its way into nearby waterways. Because agricultural depends primarily on nonpoint sources for irrigation, runoff with high levels of sedimentation are a high concern. As shown above, a greater number of respondents specify that they have participated in a short course on water quality practices. On the other hand, 12% of contestants indicated that they had not taken interest in a short course on water quality practices.

GRAPH 4. WATERSHED GROUP OR EQUIVALENT



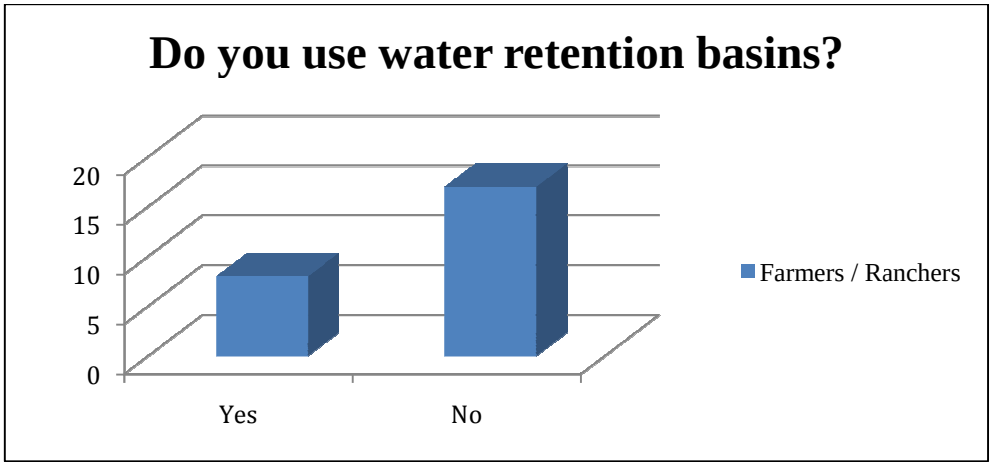
Twenty out of 25 correspondents indicated that they were apart of a watershed working group or an equivalent group. Although, only five, or 20 percent, of those whom responded indicated that they did not belong to a watershed or comparable group.

GRAPH 5. WATER QUALITY ASSESSMENT TECHNIQUE



Eighty-four percent of people who responded to this survey indicated that they use a water quality assessment technique on their land weather it be well-managed irrigation systems, and retention basins. A low respondent fraction of 16 percent responded that they had not yet implemented a water quality assessment technique on their property.

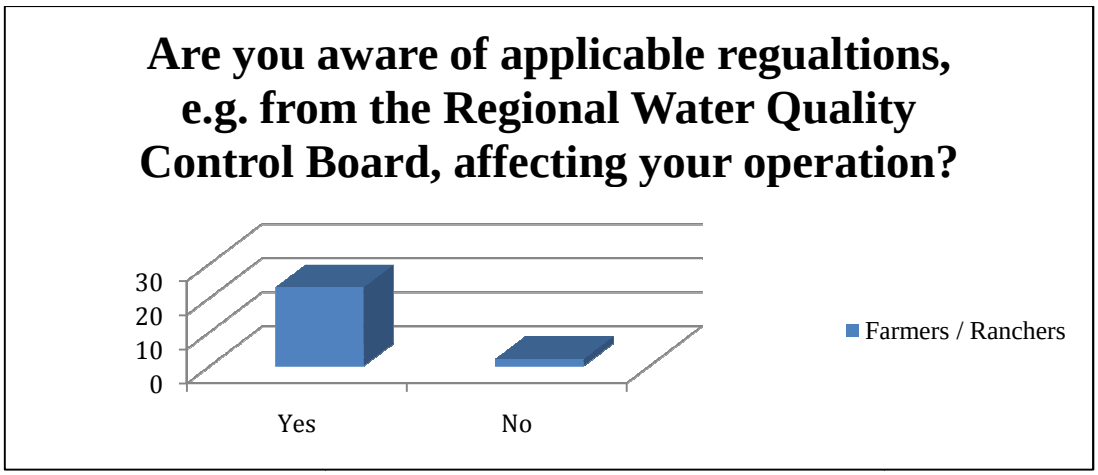
GRAPH 6. USE OF WATER RETENTION BASINS



Water retention basins may be one of the most important water quality assessment techniques. Many more respondents indicated that they did not use water retention basins.

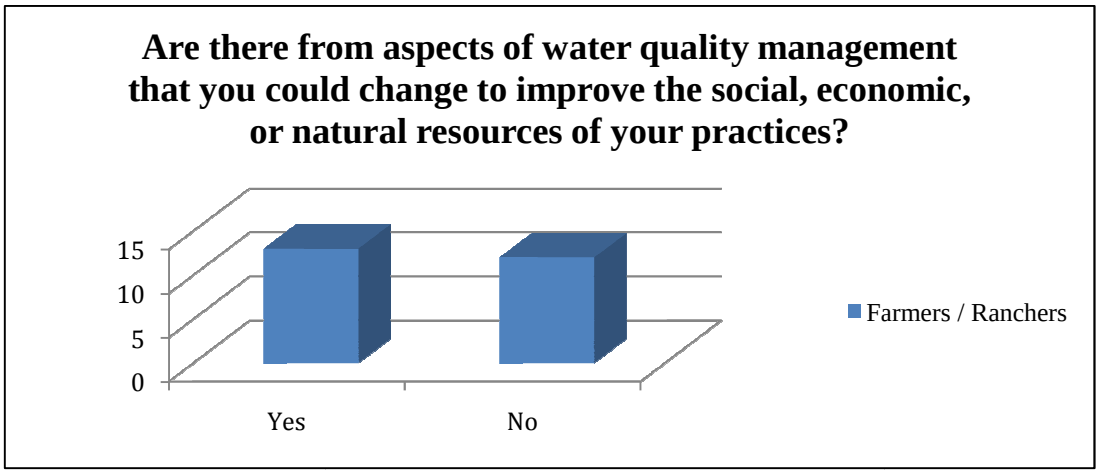
Seventeen out of 25 indicated that they had not implemented this type of water quality technique on their land. Eight farmers indicated that they did indeed use this beneficial water quality practice.

GRAPH 7. REGULATION AWARENESS



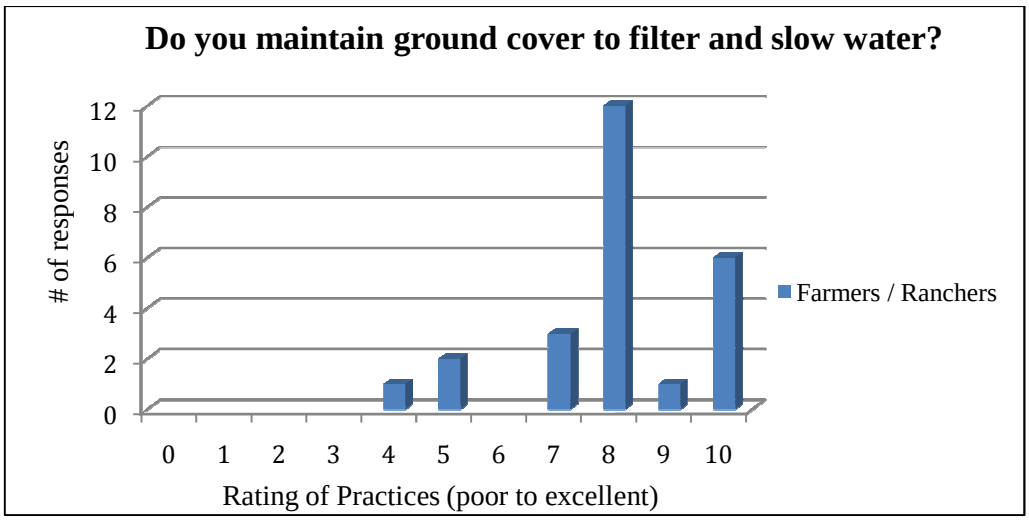
Ninety-two percent of respondents indicated that they were aware of the regulations from the Regional Water Quality Control Board. Two out of 20 individuals reported that they were unaware of these regulations.

GRAPH 8. WATER QUALITY MANAGEMENT



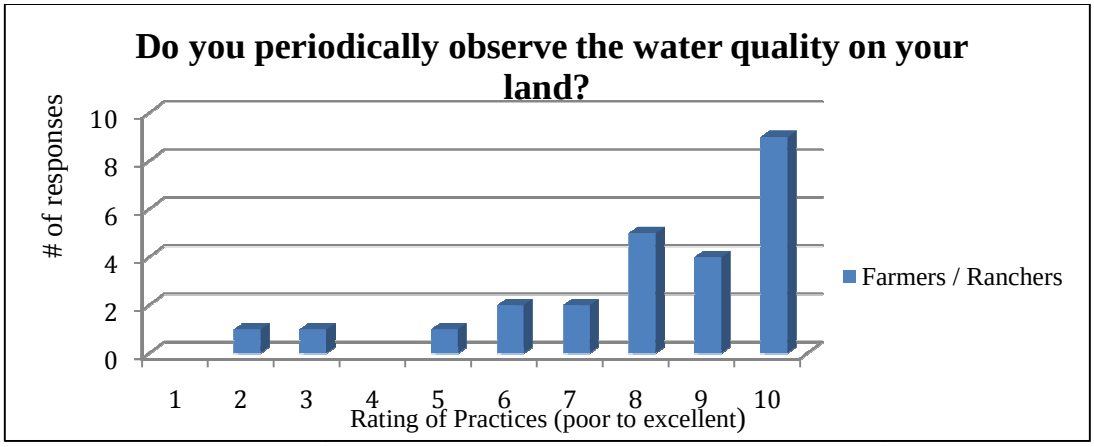
Fifty-two percent of participants indicated that they would change the social, economic, or natural resources of their practices. Whereas, forty-eight percent of respondents decided that they would not change anything about their farming practices.

GRAPH 9. GROUND COVER MAINTENANCE



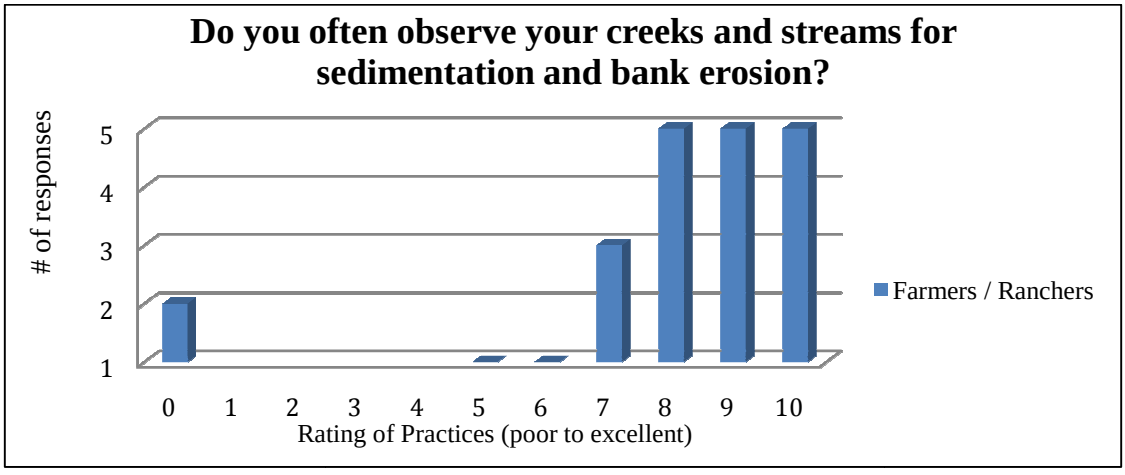
One out of 25 respondents believed their operation to earn a 4 out of 10, two out of 25 individuals rated their ground cover practices to rate a 5 out of 10. Three people thought that their ground cover would earn a practice rating of 7 out of 10. The most common rating for ground cover can be seen above with an 80% practice rating, twelve individuals identified their facility to exemplify a rating of 80% for their ground cover rating. One respondent gave their facility a 9 out of10 and six individuals marked themselves as practicing excellent (10 out of 10) ground cover practices.

GRAPH 10. WATER QUALITY OBSERVATION



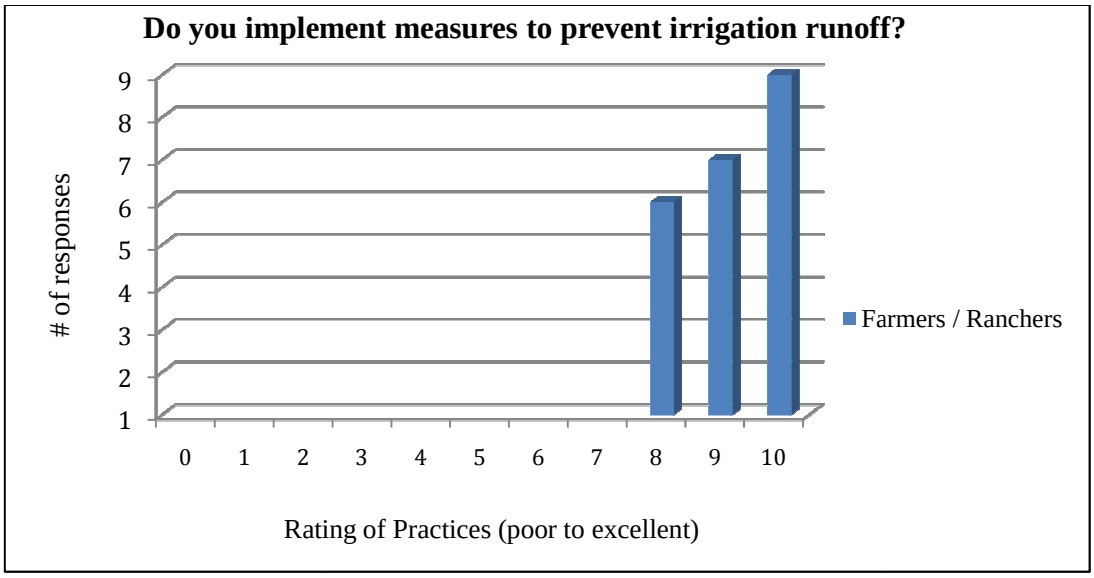
One respondent rated their water quality observation to be a 2 out of 10, a 3 out of 10 and a 5 out of 10. Two out of 25 participants rated their practices a 6 out of 10. Two respondents indicated that their water quality observation practices should earn a 70 percent out of 100. Five people rated their practices to have earned a 80% practice rating as well as four people recorded a 90% water quality observation rate. Overwhelmingly, nine out of twenty-five respondents indicated that they have excellent water quality observation practices on their facility.

GRAPH 11. SEDIMENTATION AND EROSION



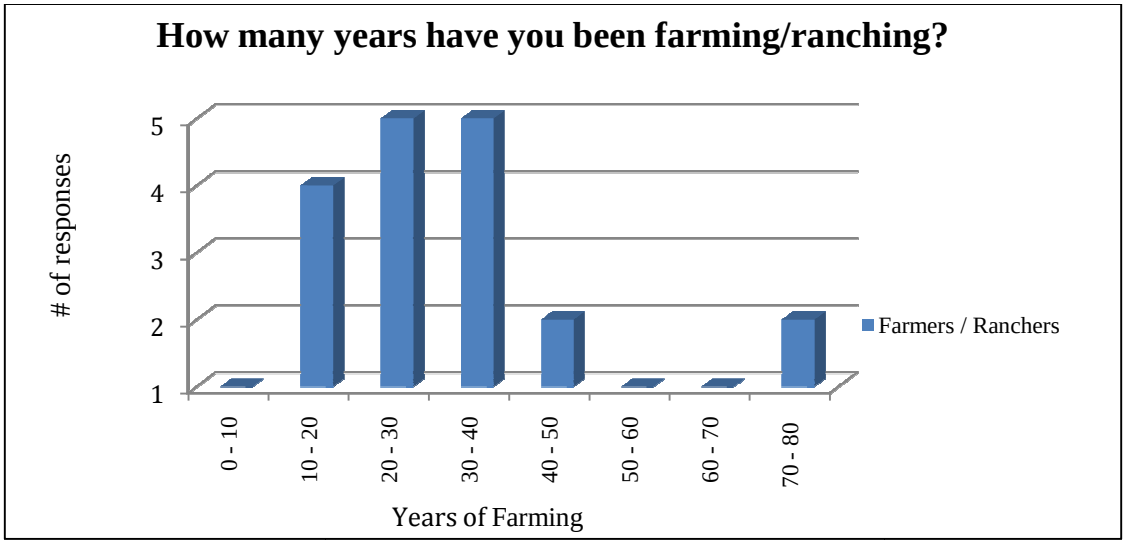
Two out of 20 respondents indicated that they did not have creeks or steams to check for sedimentation. One out of 25 participants indicated that they did not show acceptable practices with a rate of 5 out of 10. Another single participant rated their stream observation with a 6 out of 10. Three out of 25 people recorded that they practiced a 70% creek and stream observation rate. Twenty-four percent of respondents replied by indicating that they show a high rating of 8 out of 10 for creek and stream observation. Slightly lower than an 80% observation rating, five people indicated that they practice a high 90% average rating for observing their creek and streams for sedimentation. Lastly, seven out of twenty-five participants indicated that they practice excellent observations of nearby streams and creek for sedimentation.

GRAPH 12. IRRIGATION RUNOFF



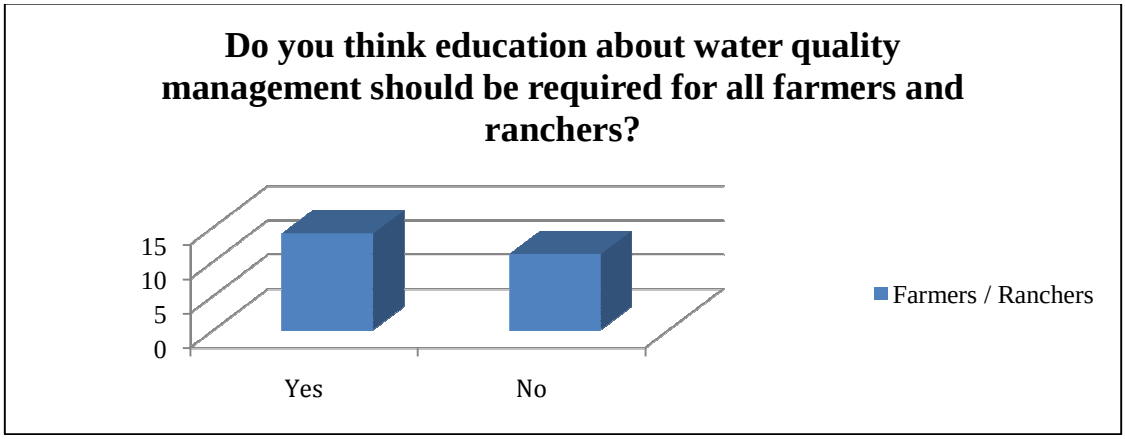
Six out of twenty respondents rated their irrigation runoff prevention practices an 8 out of 10. Twenty-eight percent of respondents rated their facility to implement a 9 out of 10 rating for irrigation runoff management. Twelve out of 20 participants rated themselves 10 out of 10, an excellent rating, for irrigation runoff prevention practices.

GRAPH 13. YEARS RANCHING/FARMING



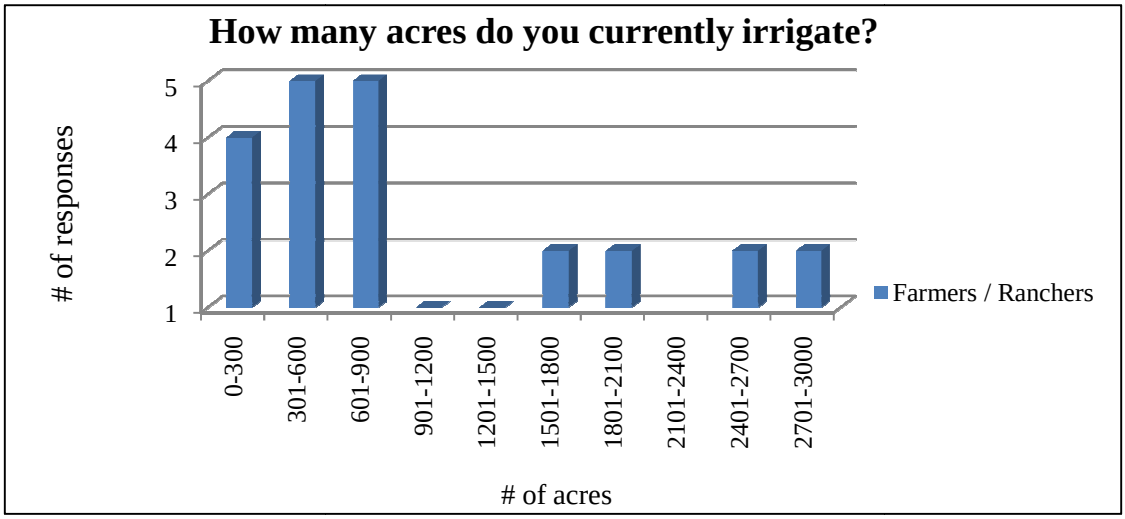
Only one out of 25 participants has been farming for less than ten years. Four out of 25 people have been farming between ten and 20 years. Six out of 25 participants have been farming between twenty and thirty years. The highest number of participants, thirty-two percent, has been farming for 30 to 40 years. Only one participant has been farming for fifty to sixty years. One participant's family has been farming for sixty to seventy years. Lastly, two participants out of twenty indicated that their families have been farming for 70 to 80 years.

GRAPH 14. WATER QUALITY EDUCATION



Fifty-six percent of respondents thought that education should be required for water quality management, whereas the other forty-four percent of participants disagreed. 14 out of 25 participants believed that education should not be required. Survey's which answered "No" also indicated that education should be available but not required, should be a volunteer opportunity and also mentioned that education should still be strongly encouraged.

GRAPH 15. ACRES OF IRRIGATED LAND



Four out of 25 participants indicated that they irrigate less than 300 acres. six survey participants recorded that they irrigate between 300 and 600 acres. Five respondents said that they irrigate 600 to 900 acres. One participant indicated that they irrigate 900 to 1,200 acres. One out of twenty five claimed to irrigate between 1,200 and 1,500 acres. Two out of 25 respondents recorded that their operation irrigated 1,500 to 1,800 acres. Two participants irrigate 1,800 to 2,100 acres as well as two other participants also irrigate 2,400 to 2,700 acres. One participant indicated that their facility irrigated between 2,700 to 3,000 acres.

The study has shown that participation within sustainable water quality education and implementation of water quality assessment techniques on farmland to have a high articulation. The second question on the survey referred to participation in a water quality-planning workshop, 23 respondents indicated that they had attended a workshop. Closely related, 21 out of 25 participants recorded that they had implemented some sort of water quality assessment technique on their facility. Fifty-six percent of participants felt that education about sustainable water quality practices should be required and the other forty-four percent of respondents indicated that they did not feel like education should be required but most said that it should be highly encouraged. Due to the results from respondents, estimations revealed early in the study were generally accepted due to the fact that educational awareness had a profound effect on sustainable water quality practices being implemented on farms. The hypothesis earlier mentioned in the report states that the higher number of respondents to attend a water quality management workshop, the higher level of adoption of water assessment techniques. This hypothesis was accepted due to results given previously.

DISCUSSION

Reactions that the survey participants supplied were pleasing. It's intriguing that so many farmers agreed that education on sustainable water quality practices should be required for all farmers who have irrigated land. Of those other 50 who disagreed, many of the surveys had notes saying things like "it should be a volunteer opportunity" or "it should be highly encouraged." There were even responses from those participants who answered "No" whom wrote that "it's a good thing to learn" and it should "be made available." There was reluctance when sending these surveys to see how farmers and ranchers would respond to this survey since water can be such a "touchy" subject. The

majority of respondents seemed very positive about sustainable water quality implementation due to the fact that 17 out of 20 participants had participated in a water quality-planning workshop.

The results from number 12 on the survey, which asked the farmer/rancher to rate their property from 1 to 10 by their measures to prevent run off, were also very positive. Eight out of 20 participants gave their facility a 10 out of 10 (or 100%) for regulating run off on their property. This was especially important due to the fact that there have been such high concerns regarding this water quality technique. Surprisingly, the numbers of irrigated acres that each facility was responsible for was very high. The acreage numbers varied from 200 to 3,000 acres that were irrigated. This is a high financial responsibility as well as a very large number to observe for water quality.

Implications of this study suggest that educational involvement is highly preferred if responsible water quality management is to take place on an operation. Also, the demographics of the respondents did not affect the likely-hood to adopt sustainable management practices. Instead, the involvement with a watershed or an equivalent group, participation in water quality planning workshops and awareness of regulation do affect the likely-hood of adopting more environmentally friendly practices on large and small scale agricultural operations.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on the findings, the conclusions of this study were:

- Education has a high articulation with implementing sustainable water quality practices on farm/ranch land.
- The observation of water quality on respondent's land is very high.
- There is a high level of awareness as to different water quality assessment techniques among farmers and ranchers.
- There exists a moderate awareness that there is a potential to implement better water quality management within operation but agricultural producer has not yet decided to implemented practices.
- Many participants indicated that they belong to a watershed or an equivalent group. By being apart of an equivalent group helps makes a point that water is being monitored very regularly and also ensures that the facility will be held responsible if water quality toxicity levels were to rise.
- An increased in the positive rate of practices regulating run off from land to nearby water-ways was apparent. This could be one of the most important and meaningful points that can come away from this project due to the fact that most of the water toxicity that California growers are faced with today come from toxins passed into nearby waters by runoff from farmlands or equivalent.
- Educational opportunities about sustainable water quality have in fact affected level of implementation practices on farmland.

- A positive awareness among respondents of water quality regulations done through the California Water Quality Control Board.
- Most of respondents made water quality an important component of their facility by attending educational workshops and in-hand implementing their learned practices upon their land.
- The most common number of years farming of the twenty-five respondents indicated to be thirty to forty years of practice. These numbers indicate that farmers are of an older generation but still showing interest in implementing new strategies to help efficiency, longevity and prosperity on their facility by using sustainable water quality practices.
- The initial hypothesis within this study was that farmers of younger generations would be more likely to implement sustainable water quality practices due to the fact that the views on farming are different today than they were 50 years ago. Therefore, the hypothesis stated early in this study was not effectively accepted due to the fact that there were five out of 25 respondents whom had been farming for 20 years or less.

RECOMMENDATIONS

Recommendations for future research would include:

- Asking respondents for their names and whether they had any college education as an alternative/additional question to the survey. By doing this, one could better determine the implementation practices within ages of farmers instead of only asking for the number of years they had been farming/ranching.

- With more time, attending a day at work with an engineer at the Central Coast Regional Water Quality Control Board would be beneficial. By doing this, one would have had hands on experience about these water quality-monitoring techniques described throughout the study and this might have increased author's awareness for writing an effective report.
- The use of online tools for creating and sending of surveys such as Survey Monkey may have increased participation. A downfall to this approach would have been those farmers and ranchers who did not access the Internet. But, this could also apply to the demographics associated with the survey sample of farmers and ranchers. With this approach, one would most likely need to contact farmers and ranchers by telephone and/or U.S. mail as well as online. By asking for advice over email, this would also assess farmers and ranchers reluctance to the web friendly world that we live in today.

SUMMARY

This study used a fifteen-question survey to identify the articulation between education of water quality practices and the willingness to implement sustainable water quality techniques on farmland according to twenty-five agricultural operations residing on the Central Coast. Questions one through eight asked respondents to indicate their agreement or disagreement with various water quality assessment tools. Questions nine through twelve asked respondents to personally rate their operation's level of water quality management on a scale from one to ten. Questions thirteen through fifteen were open-ended questions to generate responses about demographics. Consensus was reached that the higher the level of education about water-quality planning techniques, the higher

the adoption rate of sustainable water quality implementation on farmland. In essence, this means less likelihood for surface water runoff and a high level of compliance with water-quality regulation

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APPENDIX

APPENDIX A – SURVEY

Sustainable Water Quality Self-Assessment

Healthy grasslands and woodlands will absorb water and slow its pace, reducing erosion and siltation of waterways. Maintaining residual forage cover at the beginning of seasonal rains is important to assuring that the water leaving your land is as clean as possible. Proper road construction and maintenance is essential to preventing unnecessary siltation of nearby water bodies.

Please answer Yes or No to the following questions

Check answer that best applies

1) Are you familiar with a water quality assessment technique?	☐ Yes	☐ No
2) Have you participated in a water quality planning workshop?	☐ Yes	☐ No
3) Have you completed a short course on water quality practices?	☐ Yes	☐ No
4) Are you a part of a watershed working group or an equivalent group?	☐ Yes	☐ No
5) Do you participate in a water quality assessment technique?	☐ Yes	☐ No
6) Do you use water retention basins?	☐ Yes	☐ No
7) Are you aware of applicable regulations, e.g., from the Regional Water Quality Control Board, affecting your operation?	☐ Yes	☐ No

8) Are there some aspects of water quality management that you could change to improve the social, economic, or natural resources of your practices?

Please write reponse here:

Please rate your practices on a scale of 0-10 (poor to excellent)

Circle answer that best applies

9) Do you maintain ground cover to filter and slow water?	0 1 2 3 4 5 6 7 8 9 10
10) Do you periodically observe the water quality on your land?	0 1 2 3 4 5 6 7 8 9 10
11) Do you often observe your creeks and streams for sedimentation and bank erosion?	0 1 2 3 4 5 6 7 8 9 10
12) Do you implement measures to prevent irrigation runoff?	0 1 2 3 4 5 6 7 8 9 10

Please answer the following questions:

13) How many years have you been farming/ranching?

14) Do you think limited education about water quality management should be required for all farmers and ranchers?

15) How many acres do you currently irrigate?

THANK YOU for taking the time to complete this survey!

APPENDIX B- NOTIFICATION POST CARD

October 2, 2009

«Company»
«First» «Last»
«Address»
«City», «State» «Zip»

«GreetingLine»
I am a senior at Cal Poly, San Luis Obispo, and currently studying Agricultural Science with a minor in Agricultural Business. I am in the process of completing my senior project and would greatly appreciate your assistance. In approximately one week, you will receive a request to fill out a water quality sustainability self assessment score sheet. The purpose of this survey is to examine the implementation of sustainable water quality practices on agricultural land. The results of the self assessment will provide valuable information to further the understanding of sustainable agriculture within the community. If you have any questions or concerns please do not hesitate to contact me by emailing kmillhou@calpoly.edu or by calling (707) 695-3999. You may also contact my advisor Wendy Warner by email at wjwarner@calpoly.edu or by calling her office at (805) 756 - 2401.
I would like to thank you in advance for your time and consideration.

Sincerely,

Kortnie Millhouse
Agricultural Science Student
Cal Poly, San Luis Obispo
Agriculture Education & Communication Department

APPENDIX C – SURVEY WITH LETTER

October 7, 2009

<<AddressBlock>>

<<GreetingLine>>,
I am writing to request your assistance in the completion and return of the enclosed survey. This survey is currently being completed by 40 other agriculturists in the San Luis Obispo County.

While your response to this request is completely voluntary, I would greatly appreciate your participation with this meaningful study. Results from the survey will contribute to the understanding of sustainable agriculture management practices and willingness to participate in this effort. There are no anticipated risks, compensation, or other direct benefits to you as a participant in the study. Your answers to the survey questions will be anonymous and confidential.

If you have any questions or concerns please do not hesitate to contact me by phone at (707) 695-3999 or by email at kmillhou@calpoly.edu. You may also contact my advisor, Wendy Warner, at (805) 756-2401 or by email at wjwarner@calpoly.edu. Your completed survey may be returned using the postage paid envelope. I encourage you to return the requested information to me by November 13th, 2009. Thank you for your assistance with this project. Your comments are very important to me.

Sincerely,

Kortnie Millhouse
Agricultural Science Student
Cal Poly, San Luis Obispo
Agriculture Education & Communication Department

APPENDIX D – FOLLOW-UP SURVEY

October 21, 2009

<<AddressBlock>>

<<GreetingLine>>,
I am writing to request your assistance in the completion and return of the survey sent to you on October 7th. Enclosed you will find an instant coffee packet brought to you by Starbucks Coffee. I encourage you to sit down, relax, and enjoy a hot cup of coffee with me while filling out the fifteen-question survey.

Please remember, while your response to this request is completely voluntary, I would greatly appreciate your participation with this meaningful study. Results from the survey will contribute to the understanding of sustainable agriculture management practices and willingness to participate in this effort. There are no anticipated risks, compensation, or other direct benefits to you as a participant in the study. Your answers to the survey questions will be anonymous and confidential.

If you have any questions or concerns please do not hesitate to contact me by phone at (707) 695-3999 or by email at kmillhou@calpoly.edu. You may also contact my advisor, Wendy Warner, at (805) 756-2401 or by email at wjwarner@calpoly.edu. Your completed survey may be returned using the postage paid envelope. I encourage you to return the requested information to me by November 13, 2009. Thank you for your assistance with this project. Your comments are very important to me.

Sincerely,

Kortnie Millhouse
Agricultural Science Student
Cal Poly, San Luis Obispo
Agriculture Education & Communication Department